# HIP – A Technology-Rich and Interactive Multimedia Pedagogical Platform

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**Abstract.** Technology enhanced learning is a key part of learning and teaching in most of the higher education. It not only provides easy access to pedagogical content of interest with few clicks, but it is a great way to acquire knowledge at ones doorstep. Many universities are providing distance and blended education programs through eLearning platforms, learning management systems (LMS) and smart tools, along side traditional lectures for on campus students. The use of recorded lecture videos and audios, lecture notes, presentation slides, handouts, etc., are commonly used to disseminate knowledge via various eLearning platforms. While these platforms are a good way to reach out to off-campus students, they often lack a two-way communication between a student and a teacher, and the interactivity with the content. The lack of real-time interactivity and right communication channel make online courses less effective. To address this problem we propose the use of an intelligent pedagogical media called hyper interactive presenter (HIP).

**Keywords:** eLearning, pedagogical platforms, hyper media, interactive media, intelligent chat bot.

## 1 Introduction

Numerous eLearning platforms, educational tools, learning management systems (LMS), and open educational video resources have emerged in the last decade with rapid development in eLearning technology. These include Fronter [1], ATutor [2], Moodle [3], Khan academy [4], Coursea [5], edX [6] etc. These eLearning platforms and tools provide useful mechanism of delivering educational resources for distance and blended education. The resources normally comprise of recorded lecture videos, PowerPoint presentation slides, audio transcripts, and related documents. They are stored locally on the server or in learning object repository (LOR) such as MERLOT [7] , either centrally or distributed. Learning objectives are defined and meta-data is associated with these resources before they are distributed to masses as learning objects (LO) [8], via eLearning platforms.

Despite successfully delivering the LOs, existing LMS and other eLearning platforms still have not succeeded in capturing the real essence of a LO i.e. interoperability, reusability, and most importantly the interactivity. Users may be able to browse, locate and view the content in existing systems but they often

P. Zaphiris and A. Ioannou (Eds.): LCT 2014, Part I, LNCS 8523, pp. 151–160, 2014.

cannot navigate to certain portion within the text, audio or video content. The associated meta-data is often used only to search, store, and index educational resources. It hasn't been used to train and teach the system to adapt itself based on users' learning needs.

Theories like learning styles should also be taken into consideration. Learning styles is a theory developed based on the fact that the ability of every individual to process information differs during the learning process. In other words, every individual learns in a different way [9]. Although studies showed no concrete evidence that learning styles can improve the knowledge acquisition process of students in classroom environment, they nevertheless remained significant and resulted in different models in order to categorize learning style [10].

With the evolution of eLearning, more studies were conducted in order to see if the learning styles affect the quality of learning through eLearning platforms and if there is any difference between the way of learning through the classroom and the eLearning platforms. The findings of studies like the one performed by Manochehr [11], showed that learning styles although they are irrelevant when the students are in a classroom, they had statistically significant value according to the knowledge performance in a web-based eLearning environment.

There are possibly many ways to transfer knowledge to individuals based on their learning style [12]. The success of a learning process is depended upon two factors – users' learning style or preferences and the way the knowledge is presented to the user. Fleming's VARK model [13] has grouped learners into four categories: visual, audio, read/write and kinesthetic. To aid the learning process, we need to deliver the educational resources adhering to users' preferences based on their learning style [14]. Existing eLearning platforms mostly rely only lecture videos, which tend to be oriented towards visual learners. In addition, lecture videos are often quite large, lacks interactivity, and are normally non-structured. This makes it difficult for the learners to keep their interest level high.

In this paper, we propose a technology-rich pedagogical media platform called hyper interactive presenter (HIP). The aim of HIP is to provide an interactive learning environment to users by incorporating the concept of nano-learning [15], and to address the above stated issues by creating effective multimedia learning objects (MLO); a platform where users can interact with educational content comprising of structured multimedia. The platform is in development stage and is currently being used for research purpose only.

The rest of the paper is organized as follows. In section 2, we present the proposed platform. Section 3 presents the initial experimental results on the evaluation of HIP, while section 4 concludes our paper.

## 2 Hyper Interactive Presenter

HIP is an eLearning platform that provides technology-rich pedagogical media for continuous education and connected learning. It combines four media modalities to suit ones learning styles. These include text documents such as wiki pages and pdf documents, PowerPoint presentations, lecture videos (visual/aural), and

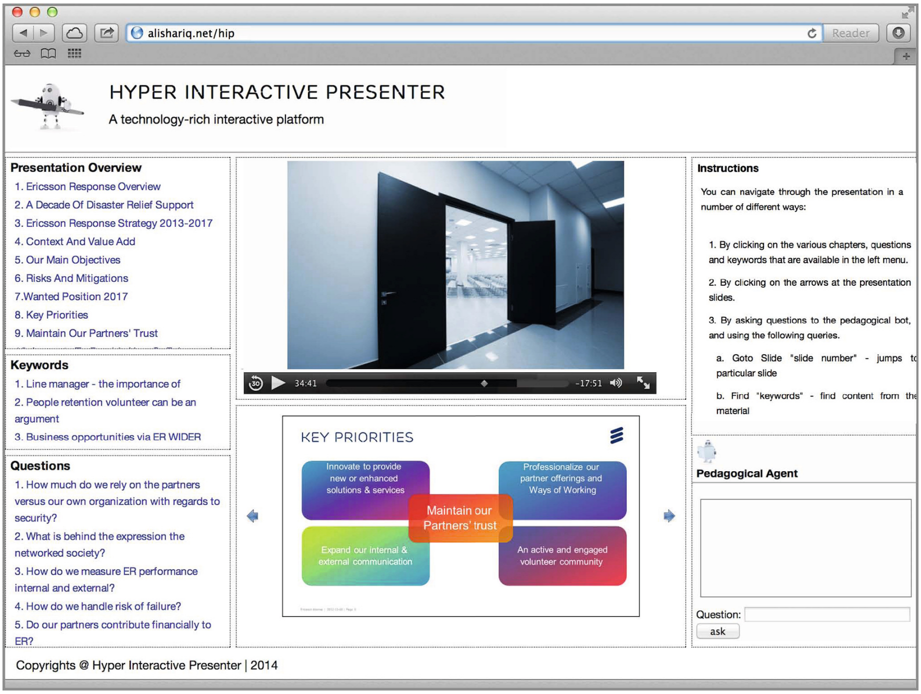


**Fig. 1.** A sample screen shot of hyper interactive presenter (HIP)

an interactive dialogue (intelligent pedagogical agent) along with navigational links, tagged keywords, and frequently asked questions (FAQ). HIP supports nano-learning by creating smaller chunks of video learning objects (VLOs), and hyperlinking similar LOs across different media.

HIP comprises of many media elements, which are assembled in different sections (components), and are bundled (interlinked) together to form a HIP page. These components are designed to support different types of learning styles. Figure 1 shows an example of a HIP page layout with different components.

## 2.1 HIP Components

HIP comprises of four main components. The components are designed to present the knowledge in number of ways, utilizing all the available media modalities. These include hyper-video, PowerPoint presentation slides, documents, and a pedagogical agent. We use these different media modalities in HIP to map the VARK model, in order to support variety of learning styles.

It is a well-established fact that about approximately 65% of the population are visual learners while others are textual learners [16], and 90 percent of information that comes to the brain is visual [17]. HIP therefore, supports different learning styles by combining visual information with the text, and by providing users with an intelligent pedagogical chat bot to engage in a discussion. This is achieved by interlinking different components together, which are briefly explained in the following section.

**Hyper-Video.** Recorded lecture videos are used as an educational resource to primarily assist visual and auditory learners. Lecture videos are usually very long. A lecture video can often last for one to two hours and it can contain a variety of different information, covering one or more subjects. For these reasons lecture videos are very rich media with high complexity. Even though numerous lecture videos are available on the web, most of the time they lack the necessary supporting information and metadata; they are usually unstructured, unedited, and non-scripted. This makes it extremely difficult for the interested student to find relevant information easy and fast. Taking bandwidth limitations into account the process becomes even more challenging.

HIP on the other hand, provides a hyper-video; segmented, structured and edited VLO, based on the concept of nano-learning. A lecture video undergoes a series of image and video processing steps to identify area of interest (AOI). The AOI could be a start of a question, a new topic, or a pause during a lecture etc. The identified AOIs are used as index points to create a smaller segment of a video called VLO from the full-length instructional video. The index points are used to create hyperlinks to jump to particular timestamps in the video for quick navigation.

**PowerPoint Presentations.** The second main component that defines HIP consists of PowerPoint slides. The use of slides caters to visual as well as textual learners. PowerPoint presentations are processed independently to create images of slides that are used in the HIP. The images are synchronized with corresponding lecture video via presentation overview. A presentation overview provides navigational links to jump directly to a desired slide and to corresponding timestamp in a video. Each slide title is automatically extracted to create a presentation overview.

Semantic keywords are also extracted from presentation slides to create navigational links and tag clouds. A tag cloud represents important words used in the instructional content. The more important a word is in the given context the bigger its size in a tag cloud. The importance of a word is computed based on its frequency, its font size in PowerPoint slides, and the amount of time it was visible in a particular shot in the corresponding video. Tag clouds are used to provide a time-aligned navigation to hyper-video, PowerPoint presentation slides, and text documents. Figure 3 shows an example of a tag cloud.

**Documents.** The document section is aimed at textual learners, learners who prefer to read and go through details rather than watching and listening to videos and to slides. The document section primarily constitutes lecture notes, handouts, and/or wiki pages. These documents provide detailed content and


**Fig. 2.** An example of a 3-dimensional tag cloud for HIP.

additional references to presented material in lecture videos and PowerPoint slides.

**Pedagogical Agent.** The pedagogical agent is an artificial intelligent markup language (AIML) based chat bot that act as the brain of the HIP. It is primarily intended for a variety of different learning styles. For instance, it can benefit learners that like to read and write. It is also very useful for auditory learners that learn better through discussion.

The pedagogical agent provides interactivity to the user, responds to their queries, find relevant material and concepts from within the lecture material including lecture videos, PowerPoint slides, and documents, and it communicates with users. The pedagogical agent has to be fed with the course domain knowledge to be able to interact intelligently, and engage in a discussion with users. The chat bot is a great way to interact with the user in real-time in absence of a teacher, as is normally the case with existing eLearning platforms. This will most likely keep users interest level optimal, and will help speed up the learning activity.

In addition, the relevant meta-data information is also extracted for each segment of a LO. The meta-data partially comes from videos such as the timestamps i.e. start time and the end time of a particular segment, and partially from accompanying material such as PowerPoint slides, audio transcripts and other textual documents. The meta-data is used for creating hyperlinks among different media components of same LOs, and for segmentation and structuring of MLOs.

### 2.2 HIP in Action

HIP provides two-way synchronization between PowerPoint slides and corresponding lecture videos. For instance, if someone browse presentation slides, the video automatically jumps to start of a segment in video that contains that particular slide and vice versa. At the same time, corresponding content from the document would appear in the document section. If it were a wiki document, the page containing the corresponding information would appear. Similarly, the presentation outline, extracted keywords and/or key phrases along with FAQ are all linked to their corresponding VLOs, PowerPoint presentation slides, and to accompanying documents/wiki pages.

For example, if one clicks a keyword about 'eLearning', appropriate video segment would appear which talks about the given topic i.e. eLearning in this case, and the corresponding slide would appear that was used during the talk, along with wiki page containing information about eLearning. In addition, it is possible to query the system via pedagogical agent to navigate to a particular topic simultaneously across different media.

### 2.3 Case Senario

A simple case scenario would be that a user logs into his profile and navigate to weekly lectures of the course he has registered. In weekly lectures the user is provided with synchronized and structured HIP page.

Being a visual learner a user can play a video from start and watch it till end. At the same time the PowerPoint slides automatically changes as the user progress through the video, and the corresponding document will show up. If at any stage a user feels like going through the slide for better understanding, he can pause the video and look at the corresponding slide. Likewise, he can refer to the document for even detailed information. A user can also query the pedagogical agent to inquire about a particular topic or a concept if it is not elaborated enough in the material. The agent will answer to user questions, and will find requested information. The user can then engage in a discussion with the pedagogical agent as if he is corresponding to a course instructor.

Contrary to visual learners, the textual learners can directly go through the text document or PowerPoint slides. If they do not understand any concept or topic, they can play the synchronized video from the point where they are in the slide and/or document, and listen to the explanation provided by the teacher in the video.

## 3 Experiment and Results

We conducted an experiment to evaluate the usefulness of HIP. The experiment is divided into two parts. The first part of the experiment group students into four categories based on their learning preferences. A standard VARK questionnaire was used to differentiate students' learning style and to group them as visual,

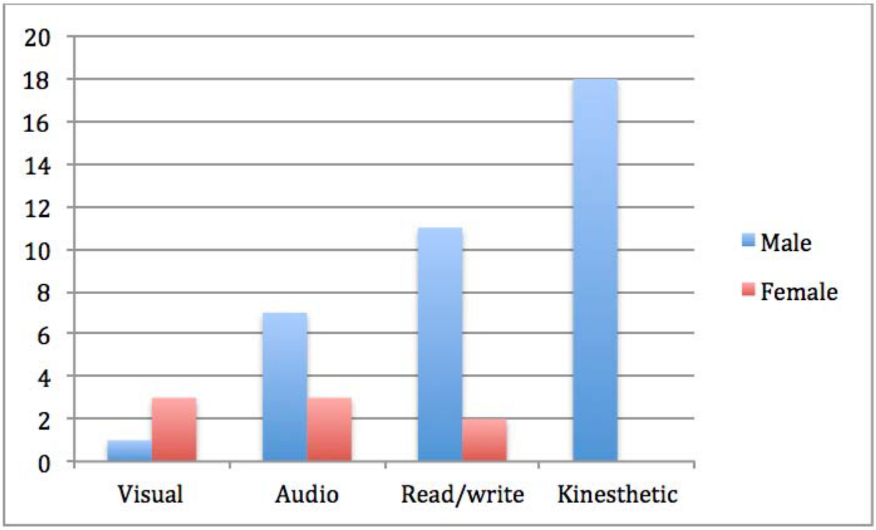


**Fig. 3.** Grouping of students based on VARK learning model

audio, text and kinesthetic learners [10]. The questionnaire was distributed to 55 students comprising of bachelor and master level at Gjøvik university college (GUC). The students were grouped into their respective category based on their learning style, to have an equal distribution for the second part of the experiment. The distribution of students is shown in Figure 3.

In second part of the experiment, the students were asked to go through the HIP and non-HIP version of recorded lectures and to give their appreciation on a Likert scale from 1 to 5, where 1 corresponds to strongly disagree while 5 corresponds to strongly agree.

The first four questions were aimed towards usability study of HIP in comparison to existing system *(fronter)* at GUC. The questions were:

1. Covering material through HIP is more useful?
2. It is easy to cover material through HIP?
3. Finding material in HIP is less time consuming?
4. Reviewing the material is easier than existing system?

The initial feedback was encouraging. 80% of the participants agree in response to first question, whereas, 5% responded neutral and 15% against it. For the second question, 85% students find it easy to cover the material through HIP, while 15% disagree. Similar trend were observed for other questions. The results are shown in Figure 4. Mostly students responded in favor of HIP when asked if they would recommend a fellow student to use HIP, and if they will prefer to use such a system to prepare for the exams. The results are depicted in Figure 5.

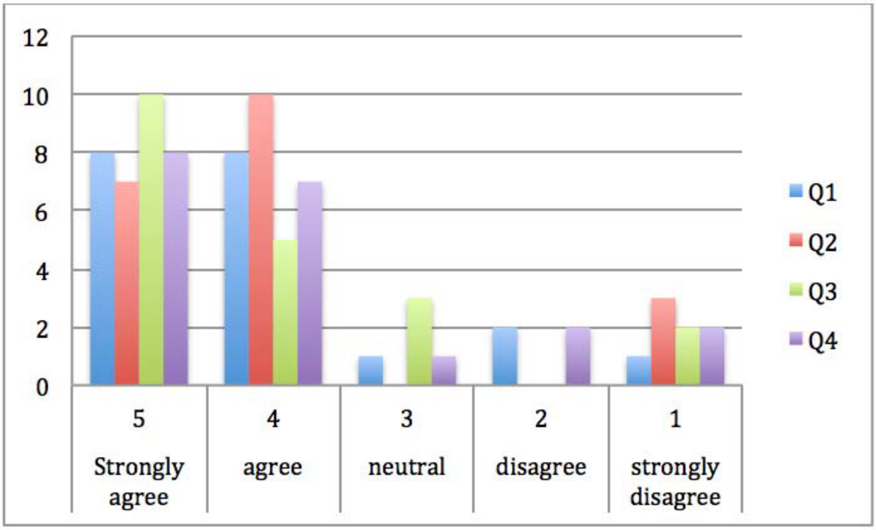


**Fig. 4.** Students' response on a Likert scale of 1-5 for first four questions

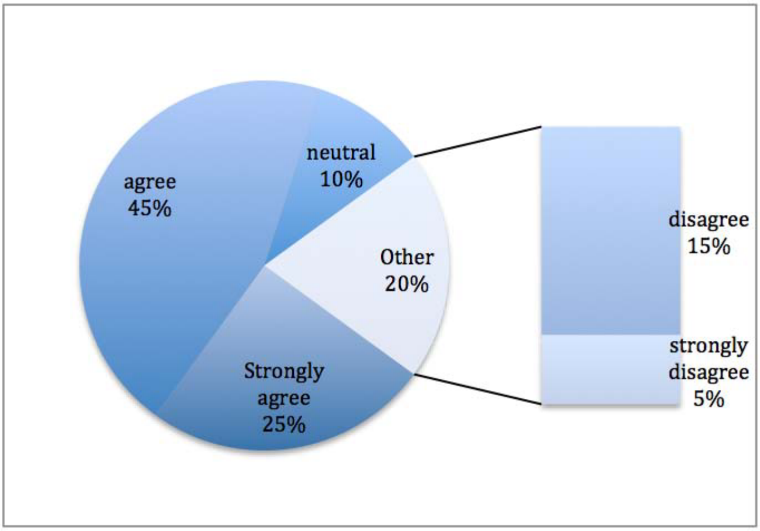


**Fig. 5.** Students' response to recommend and use HIP for preparation for exams

The findings of our initial experiment suggests that about 80% of the students would prefer HIP compared to the existing system in use at GUC. This is due to the fact that many students find it easy to navigate and jump through the material without browsing the full video and presentation slides. On the contrary, few students were reluctant to adapt to the new environment, as they were comfortable using the old one and would not like to switch.

## 4 Conclusion

HIP provides technology-rich and interactive pedagogical hypermedia that supports multiple media modalities for fast and easy navigation of instructional content. It combines text, audio/video, and PowerPoint presentation slides to best suit individual's learning style. It also provides interactive tools such as pedagogical chat bot to engage the user in the learning process. HIP provides the users with the option to use the medium they are best adapted to. Thus maximizing the learning outcome and reducing the time one spend on learning activity. From initial empirical analysis, it is safe to conclude that such a system would prove beneficial for keeping the learners interest level high and attention span longer, ultimately maximizing the learning outcome. As a future work, subjective experiments are underway to evaluate the learning outcome experience of the users and the effectiveness of such a platform.

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